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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/549,494	09/15/2005	Takatomo Sasaki	10873.1761USWO	7729

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
05/27/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/549,494	SASAKI ET AL.	
	Examiner	Art Unit	
	MATTHEW J. SONG	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-7,9-12,14,17,18,20,21,24-27,30,37,39 and 41* is/are pending in the application.

4a) Of the above claim(s) *37,39 and 41* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-7,9-12,14,17,18,20,21,24-27 and 30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/30/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/16/2009 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 3-7, 9-12, 17, 18, 20 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawamura et al ("Growth of a Large GaN single Crystal using the liquid phase epitaxy (LPE) Technique") in view of Sarayama et al (US 2002/0046695 A1) and Yamada et al (US 5,366,552).

Kawamura et al teaches a method of LPE comprising heating a reaction vessel (crucible) containing Na (an alkali metal) and gallium (Ga) to 800°C. (pg L4). Kawamura et al also teaches feeding a nitrogen containing gas (nitrogen and ammonia) and thereby allowing the Ga and nitrogen to react with each other to grow Group III nitride single crystals. (pg L4 and Abstract).

Kawamura et al does not teach heating the lower part of the vessel to generate heat convection in addition to heating the reaction vessel to prepare the flux

In a method of growing GaN from a molten mixture of Ga and Na, note entire reference, Sarayama et al teaches a method of GaN crystal growth comprising a heating a reaction vessel **2101** containing a Group III metal (Ga, Al, In) and an alkaline metal (Na, K) to form a mixed molten liquid ([0244]-[0250]). Sarayama et al also teaches feeding nitrogen and allowing Ga and nitrogen to react to grow GaN single crystals ([0244]-[0250]). Sarayama et al also teaches a convection arises in the mixed molten liquid because of a difference in temperature between the upper part and the lower part of the liquid holding vessel, thus efficient crystal growth is attained ([0246]), which clearly suggests heating the lower part of the vessel to generate heat convection in addition to heating the reaction vessel to prepare the flux.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Kawamura et al by having heat convection by having a temperature

difference within the vessel, as taught by Sarayama et al, to attain efficient crystal growth ('695 [0246]).

The combination of Kawamura et al and Sarayama et al does not teach the flux of the metal element and the Group III element are stirred to be mixed together with a nitrogen containing gas and mixed by rocking the reaction vessel.

In a method of Liquid Phase Epitaxy, note entire reference, Yamada et al teaches a rotation of a growth chamber is performed such that the angle of rotation of the growth chamber is a function of time elapsed, which period may be variable with the progress of liquid phase epitaxial growth (col 4, ln 1-40), which clearly suggests rocking the chamber during epitaxial growth. Yamada et al also teaches by tilting the chamber the solution is kept in a homogenous condition and liquid phase epitaxial growth is achieved uniformly. (col 4, ln 40 to col 5, ln 5). Yamada et al also teaches the movement of the chamber stirs the solution, thus accelerates growth rate. (col 5, ln 1-30 and col 2, ln 1-60).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Kawamura et al and Sarayama et al LPE process by rocking the vessel, as taught by Yamada et al, to stir the melt, thereby improving uniformity by stirring.

In regards to the metal element and at least one Group III element are stirred together with the nitrogen containing gas and mixed together by rocking, the combination of Kawamura et al and Yamada et al teaches crystal growth by combining Gallium metal, Na and nitrogen gas (Kawamura et al pg L4), and rotating the chamber during growth to stir (col 4, ln 25-65), this clearly suggests rocking to stir the metal, Group III and nitrogen gas.

Referring to claim 3, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches rotation of the growth chamber. ('552 col 4, ln 40-65).

Referring to claim 4, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches a thin film formed by MOCVD and growth on the film. (Kawamura pg L4).

Referring to claim 5, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches growing continuously. (Kawamura pg L4).

Referring to claim 6-7, the combination of Kawamura et al, Sarayama et al and Yamada et al tilting the chamber to start and stop the liquid epitaxial growth process ('552 col 5, ln 35-50 and col 4, ln 25-67), which clearly suggests tilting the chamber to prevent the mixture from coming into contact with the substrate.

Referring to claims 9-12, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches Ga metal to form GaN using a Na flux. (Kawamura pg L4).

Referring to claim 17, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches a temperature of 800°C and a pressure of 5 atm (0.5 MPa) (Kawamura pg L4).

Referring to claim 18, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches nitrogen and ammonia. (Kawamura pg L4).

Referring to claim 20, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches single crystals of GaN. (Kawamura pg L4).

Referring to claim 26, the combination of Kawamura et al, Sarayama et al and Yamada et al teaches transparent GaN. (Kawamura pg L5).

4. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawamura et al ("Growth of a Large GaN single Crystal using the liquid phase epitaxy (LPE) Technique") in view of Sarayama et al (US 2002/0046695 A1) and Yamada et al (US 5,366,552), as applied to claims 1, 3-7, 9-12, 17, 18, 20 and 26 above, and further in view of Kawamura et al ("Synthesis of Bulk GaN single crystals using Na-Ca flux").

The combination of Kawamura et al, Sarayama et al and Yamada et al teaches all of the limitations of claim 14, as discussed previously, except the ratio of Ca to the sum of Na and Ca is in the range of 0.1 mol% to 99 mol%.

In a method of making GaN using a Na-Ca flux, note entire reference, Kawamura et al teaches Ca increases the yield of GaN crystal and transparent GaN single crystals are easier to grow. (Abstract). Kawamura et al also teaches a variety of concentrations of Na and Ca which are within the claimed range of 0.1-99 mol%. (Table 1 and pg L1440-1441).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Kawamura et al, Sarayama et al and Yamada et al by adding Ca, as taught by Kawamura et al, to increase yield and making growing transparent crystals easier.

5. Claim 21, and 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawamura et al ("Growth of a Large GaN single Crystal using the liquid phase epitaxy (LPE) Technique") in view of Sarayama et al (US 2002/0046695 A1) and Yamada et al (US 5,366,552), as applied to claims 1, 3-7, 9-12, 17, 18, 20 and 26 above, and further in view of Shibata et al (US 6,270,569).

The combination of Kawamura et al, Sarayama et al and Yamada et al teaches all of the limitations of claim 14, as discussed previously, except using impurities.

In a method of growing GaN from a melt, note entire reference, Shibata et al teaches Mg was added to a Ga melt to thereby grow a Mg doped GaN. (col 9, ln 15 to col 10, ln 55 and col 5, ln 40-60).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Kawamura et al, Sarayama et al and Yamada et al by doping with Mg, as taught by Shibata et al, to produce a p-type GaN having desirable electrical characteristics.

Referring to claim 25, the combination of Kawamura et al, Sarayama et al, Yamada et al and Shibata et al teaches Mg.

Referring to claim 21, the combination of Kawamura et al, Sarayama et al, Yamada et al and Shibata et al teaches a substrate having a dimension of 25 mm (2.5 cm). ('569 col 13, ln 35-65).

6. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawamura et al ("Growth of a Large GaN single Crystal using the liquid phase epitaxy (LPE) Technique") in view of Sarayama et al (US 2002/0046695 A1) and Yamada et al (US 5,366,552), as applied to claims 1, 3-7, 9-12, 17, 18, 20 and 26 above, and further in view of Hawrylo et al (US 3,811,963).

The combination of Kawamura et al, Sarayama et al and Yamada et al teaches all of the limitations of claim 27, as discussed previously, except the stirring is carried out in an atmosphere of inert gas and then nitrogen containing gas is substituted.

In a method of GaN growth from the liquid phase, note entire reference, Hawrylo et al teaches a melt is formed which include gallium and materials of the melt are heated in an inert gas of hydrogen, and when the melt is completely molten, the flow of inert gas is stop and nitrogen is passed through the furnace. (col 2, ln 1-70).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Kawamura et al, Sarayama et al and Yamada et al by melting in an inert gas atmosphere and then substituting to a nitrogen containing gas atmosphere, as taught by Hawrylo et al to prevent premature reaction of the melt before the mixture is uniform.

The combination of Kawamura et al, Sarayama et al, Yamada et al and Hawrylo et al teaches stirring by rocking prior to reaction and prior to reacting, heating under an inert gas atmosphere, then substituting with nitrogen containing to cause reaction.

7. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawamura et al ("Growth of a Large GaN single Crystal using the liquid phase epitaxy (LPE) Technique") in view of Sarayama et al (US 2002/0046695 A1) and Yamada et al (US 5,366,552), as applied to claims 1, 3-7, 9-12, 17, 18, 20 and 26 above, and further in view of JP 75011870 B ('870), an English Abstract is provided.

The combination of Kawamura et al, Sarayama et al and Yamada et al teaches all of the limitations of claim 30, as discussed previously, except mixing using a stirring blade.

In a method of making a Group III-V crystal using liquid phase epitaxy, '870 teaches a molten solution is stirred with a carbon stirrer to absorb oxygen in the solution and this produces crystal with a higher purity. (Abstract). '870 also teaches rotating the stirrer. (Fig 1).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Kawamura et al, Sarayama et al and Yamada et al by stirring using as stirrer, as taught by '870, to removing an oxygen impurity and produce a uniform melt.

Response to Arguments

8. Applicant's arguments with respect to claims 1, 3-7, 9-12, 14, 17-18, 20-21, 24-27, and 30 have been considered but are moot in view of the new ground(s) of rejection.

9. Applicant's arguments filed 3/16/2009 have been fully considered but they are not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Kawamura et al is not relied upon to teach a thermal convection or rocking. Sarayama et al teaches a thermal convection to attain efficient growth and Yamada et al teaches rocking to obtain a uniformity.

Applicant's argument that by the combination of thermal convection and mechanical stirring, purity is increased and the surface of the crystal becomes smooth is noted but is not found persuasive. Applicant alleges that the convection and stirring produces unexpected results. This is mere attorney argument which lacks evidence; therefore is not persuasive. Applicant also alleges that convection and stirring allow for a transparent crystal. This is not persuasive because Kawamura et al teaches a transparent crystal without stirring or a convection (pg L5); therefore there is nothing unexpected by a process which produces a transparent crystal because a transparent crystal is taught by the prior art. Applicant compares a different Kawamura reference and not the Kawamura reference relied upon in the rejection. Furthermore, the claims are not commensurate in scope with the alleged unexpected results because there are no claim limitations regarding purity, smoothness or transparency.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Scheel (US 3,858,553) teaches a rotating chamber for liquid phase epitaxial growth. (Abstract).

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

MJS
May 21, 2009

/Robert M Kunemund/
Primary Examiner, Art Unit 1792